Incorporating "The Illuminating Engineer."

# Light and Lighting

Official Journal of the Illuminating Engineering Society.

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Edited by J. STEWART DOW

Telephone: ABBey 5215

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# Harmony — Finer than Unison

A COMMON Aim, a Common Object, need not imply a Single Voice. If everyone is drilled to say identically the same thing in similar words the mass effect may be impressive—but the influence exerted by a multitude of voices all affirming spontaneously and freely individual beliefs, and yet in combination bearing witness to a common ideal, is more widespread and permanent.

This is the method of democracy, *Harmony*—as compared with *Unison*—and, as musicians will confirm, much the finer process of the two.

This, too, is characteristic of the Illuminating Engineering Society, where many interests and shades of opinion involving frequent differences of opinion, are represented. Yet these diverse views are presented with a degree of toleration and accommodation which achieves "the greatest good of the greatest number" and comes nearest to attaining the ultimate truth.

In the Annual Report of the Illuminating Engineering Society, and in the Presidential Address delivered at its Annual Meeting on May 9th, this conception of the Society's viewpoint was well illustrated. We shall deal with both in our next issue.

## *Natural and Artificial Illumination in Architecture*

Many interesting points were raised in a paper read by Mr. R. O. Sutherland in connection with the Conferences for Architects organised at the E.L.M.A. Lighting Service Bureau early in the present year. Without light there can be no appreciation of architecture. Admittance of illumination has played no small part in influencing architectural design. In the architecture of the ancient Egyptians importance was attached to the mysticism created by deep shadows in successive small rooms, receding deeper and deeper into the heart of the temple, and the atmosphere was created by strong shafts of sunlight through small roof apertures. Curious instances of effects of visual impressions on design were mentioned—for instance the recognition that the corner column of a Greek temple appeared thinner than others when seen against the sky led to a practice of thickening this particular column.

An early application of indirect lighting for architectural purposes is found in the illumination of coffered ceilings in the peristyle of temples by light reflected from the polished marble pavings. (This hardly accords with the oft-repeated criticism that it is aesthetically wrong to illuminate classic buildings with a source situated near the ground, as is usual in floodlighting.)

The earliest architecture in Great Britain having any connection with lighting is Stonehenge, where the sun's rays appeared through an arch to illuminate the sacrificial altar. A modern counterpart is found in the Melbourne War Memorial in Australia, where a beam of light bursts into the sanctuary to light the Rock of Remembrance exactly at the eleventh hour of the eleventh day of the eleventh month.

In countries enjoying intensely bright light windows are found to be small, because maximum wall space is desired to prevent undue entrance of the sun's heat. In more temperate zones much larger windows are usual. To-day windows are associated with a broad horizontal band in contemporary architecture, but it often happens that low window-heads exclude natural light from penetrating to the back of rooms, so that it becomes necessary to use artificial light. The tendency towards large windows and high daylight intensities in buildings no doubt encourages a desire for similar high intensities from artificial sources.

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## *"Louvre Lighting"*

The Local Centre of the Illuminating Engineering Society in Glasgow was fortunate in securing a topic of considerable technical interest for its meeting on March 15 when Mr. A. B. Read read a paper on "Louvre Lighting." Mr. Read traced the evolution of lighting fittings up to the present day, and pointed out the important influence on modern design of the greater brightness of modern light sources and the higher illuminations now being demanded. Hitherto, by following familiar rules in regard to positions of illuminants, the use of diffusing glassware, etc., it has not been difficult to satisfy requirements in regard to illumination, and at the same time to avoid glare. But in the United States, where 20, 30, or even 50 ft.c. are found in stores and offices, the problem has become more difficult. Indirect lighting is one method of solving the problem, but there is now a tendency to utilise the more economical direct methods, "louvres" or other specially designed protective surfaces being introduced to screen the sources from view. Mr. Read explained, by the aid of numerous photographs and diagrams how the system can be applied, mentioning as a special instance the installation in the Boymans Museum, Rotterdam, where the City Architect, after seven years of experimenting, has developed a system of his own. This involves the use of louvres, not as elements in individual fittings but in the form of surfaces running parallel to the walls and inclined at carefully determined angles such as allow the passage of daylight, which can be supplemented or replaced by artificial light.

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## *Street Accidents by Day and by Night*

From Mr. L. A. S. Wood, Cleveland, Ohio, we receive a copy of the Program Manual, "Safety with Light," issued by the United States Junior Chamber of Commerce. This organisation also furnishes booklets, cartoons, news material, and sound-slide films, all analysing the factors determining visibility in the streets by night and the conditions favourable to safety. Some interesting points are revealed in this and associated literature. A chart shows that whilst during 1930-37, day fatalities have fallen somewhat, night fatalities have continued to rise steeply year by year. Since 1917 the ratio of night to day fatalities has just doubled. Taking the volume of traffic into consideration, it is contended that night driving is five times as dangerous as day driving. There can only be one valid explanation of all these facts—the inadequacy of present artificial lighting in streets by night as compared with natural lighting by day. Meantime lighting has not kept pace with other municipal functions. In the last twenty years the progressive increase in expenditure on schools and libraries, health and sanitation, charities and protection, has, in every case, increased much more rapidly than the amount spent on street lighting.

## Sodium Lighting in the United States

It is now five years since the first commercial sodium lighting installation was carried out in the United States. A contribution by Mr. S. B. Gaylord to the *General Electric Review* (U.S.A.) for March, shows that in the ensuing years there have been rapid developments. The Schenectady-Duanesberg road, for example, is stated to have the longest sodium-lighted highway in the world (17½ miles), whilst the San Francisco-Oakland Bay Bridge utilises 1,074 fittings with an aggregate light output of near eleven million lumens. Another field where sodium lighting seems to have been found acceptable is for the lighting of tunnels, of which there are many in America. The Liberty Tunnel in Pittsburgh, the Stockton Street Tunnel in San Francisco, and the Tooth Rock Tunnel (Washington) are mentioned as examples. As drivers commonly enter tunnels with eyes adapted to daylight conditions, a high illumination is demanded, and as this is practically a twenty-four-hour load, efficiency is obviously an important consideration. A special form of unit, completely concealing the source from the eyes of drivers, has been developed for use in tunnels where, owing to the limited headroom and confined space, it is very important to avoid glare. The 10,000 lumen lamp, rated at 180 watts and considered to be 34 per cent. more efficient than the 6,000 lumen lamps, is used for practically all outdoor installations. The fitting in general use for highways utilises a horizontal lamp with deflecting mirror surfaces, though an enclosed type of unit with diffusing globe is sometimes adopted for street intersections. An interesting point was the discovery that full light output was not attained in lamps operating in very cold areas, with temperatures 40° below zero. The difficulty was overcome by enclosing such lamps in three-wall vacuum heat-insulating flasks.

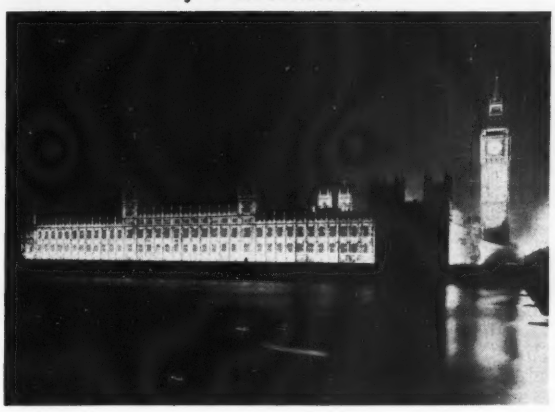
## Modern Drawing Office Lighting

In the new factory of Hugh Wood and Co., Ltd., and Huwood Mining Machinery, Ltd., one of the largest on the North-Eastern Trading Estate, Gateshead-on-Tyne, the British Thomson-Houston Company, Ltd., have introduced discharge lamps.

In the drawing offices, however, illustrated above, Mazda lamps in special fittings, designed to afford

25 ft.c., have been adopted. Each fitting houses a 150 watt bowl silvered lamp, and the extensive reflector ensures that, when the draughtsman leans over his board, no appreciable head-shadow is cast. An additional advantage of the system is that when only a few workers are staying late only the lights immediately above them need be on—thus avoiding one of the economic drawbacks of the ordinary indirect installation.

## Floodlighting the Houses of Parliament



The above photograph will serve as a reminder of the effectiveness of this installation, much admired during the Silver Jubilee and Coronation festivities. There is much to be said for the plea made by Mr. Percy Good in his recent presidential address to the Illuminating Engineering Society that the "Mother of Parliaments" should be floodlighted continuously, instead of on infrequent State occasions. In the present circumstances—when democratic institutions deserve all the emphasis that can be placed on them—the display would be timely, besides serving to brighten London's fine waterside by night. We are indebted for this picture to Messrs. Siemens Electric Lamps and Supplies, Ltd., whose lamps and equipment were used for this installation.

## Illuminating Engineering Society of Australia (Victoria)

A notable step has been taken by the above Society in producing its own *Transactions*, the first issue of which (for February, 1939) has recently reached us. Issued in a simple duplicated form with green cover, this first number is devoted mainly to domestic affairs, such as the new Constitution, in which provision is made for six grades of membership, lists of the chief committees, and notes on forthcoming meetings. One is interested to note that the Standards Association of Australia has recently issued a Street Lighting Specification which, however, is now being studied and revised in the light of information from England and elsewhere.

The *Transactions* figure as an inset to the *I.E.S. Lighting Review*, a new printed journal dealing with lighting on general lines. (In this respect the practice is not unlike that adopted in this country.) The "Review" is well illustrated and contains notes on such topics as "Street Lighting and Public Safety," "Downlighting" (with louvres), "Light in Industry," "Factors in Seeing." The President, Mr. L. D. Wright, is responsible for an editorial note, and a message of goodwill from the President and Hon. Secretary of the British Illuminating Engineering Society is reproduced.

## Luminous Signs in Paris

New regulations bearing on luminous signs are being prepared in Paris. It is not proposed to diminish this mode of publicity, but to achieve greater harmony and to avoid aesthetic defects in certain main thoroughfares. It is proposed that white light should be used in the central area, adjacent to the Opéra, the Madeleine, and the Arc de Triomphe, but coloured lights may be used elsewhere. Certain limits to dimensions may also be imposed.

## *I.E.S. Local Sub-Centres*

There is evidence of rapid progress in the two most recently formed local centres of the Illuminating Engineering Society—the North Midland Centre (with headquarters at Leeds) which was granted official status in the present year, and the Midland Centre with headquarters in Birmingham, which has just completed its first session. In both cases matters have advanced so rapidly that sub-centres, operating under the aegis of the main committee, are in prospect.

A sub-centre at Sheffield has already come into existence, with Mr. H. Wheeler as chairman and Mr. J. H. Campbell, of the Sheffield Corporation Electricity Department as hon. secretary. This development is a tribute to the efforts of Mr. J. W. Howell, who has done such excellent work as hon. secretary of the North Midland Centre, and has now been elected chairman for the coming session. The position of hon. secretary is to be filled by Mr. T. C. Holdsworth.

Almost simultaneously we hear of the project to form a sub-centre of the Midland Local Centre at Nottingham, where a meeting is being held this month. Mr. C. S. Caunt is supervising the arrangements.

## *Floodlighting Playgrounds*

We referred last month to the enterprising action of the London County Council in floodlighting children's playgrounds. The experiment has proved a definite success and has recently been extended. The subject is also handled in an illustrated booklet issued by the National Fitness Council for England and Wales. This covers somewhat wider scope as swimming pools, tennis courts, bowling greens, and other sports areas are included. Illustrations of a number of installations are appended and particulars are given of conditions of illumination and cost. Data are quoted both for gas and electric installations.

## *War Time Lighting Restrictions*

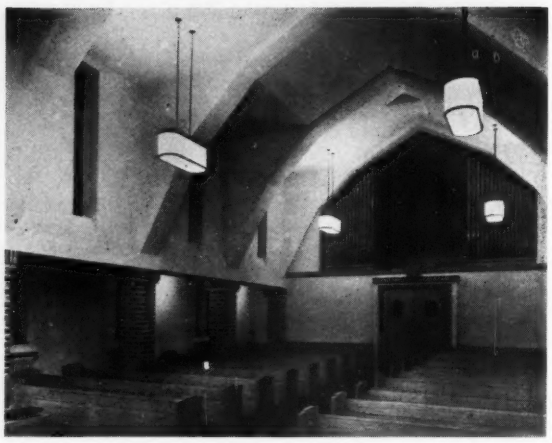
A leaflet issued by the Home Office (Air Raid Precautions Dept.)* states that in the event of war a Lighting Order will be issued under emergency legislation, imposing general darkening as a permanent condition. "Street lighting will not be permitted in time of war," but white markings and "dim, well-screened indicator lights which cast no appreciable illumination, but serve merely to show their position, will be used to mark the line of the road and also obstructions and danger points." External lights (in connection with shops, places of entertainment, etc.) will be forbidden and all advertisement lighting and illuminated signs will be prohibited.

In regard to interior lighting it will be necessary to screen all skylights, windows, and doors with dark blinds or curtains. Opacity is essential. A formula for the preparation of material suitable for treating non-opaque blinds is given. Blinds should overlap the entire window area. Glass windows may also be coated with opaque distemper and paint. (Tarpaulins should be kept in reserve as temporary covers to prevent exposure of light if glass is broken.)

In cases where the large glass area makes screening difficult and costly it may be practicable to erect light-proof structures over sections of premises where work must be conducted in darkness. In a very limited number of cases (electricity stations, boiler houses, etc.) normal lighting may be extinguished and work carried on by the aid of a few well-shaded lamps, illuminating dials, etc., without special screening, provided that no light is visible from outside the premises. The same applies to schemes based on the use of coloured lamps with filters of complementary colours applied to windows and glass roofs.

*War Time Lighting Restrictions for Industrial and Commercial Premises. (H.M. Stationery Office, 1939. 2d. net.)

## *Church Lighting*



In modern church buildings it is often possible to introduce lighting equipment which would be difficult to apply in interiors of the traditional type. A good instance is afforded by a new Methodist church at East Grinstead, illustrated above. Semi-indirect lighting, by means of fittings specially designed in collaboration with the architects, has been adopted. In each fitting three Holophane 100-watt intensive type "Stiletto" reflectors are introduced. They cast a strong beam upwards but also transmit sufficient light to illuminate the panels of the fitting, the sides and bottom of which are glazed with Montane glass, whilst the rounded panels at each end are of white flashed opal. Three such fittings are used in the short transept of this church and four more in the nave. This lighting has proved very successful and similar methods are being adopted in other churches.

## *Can Illuminated Signs be Decorative?*

A very entertaining discussion on the above topic took place at the joint meeting of the I.E.S. Commercial Lighting and Decorative Lighting Sections on March 28. We propose to give a full account of this discussion in a subsequent issue of "Light and Lighting." For the moment it is only proposed to make a very brief summary of the proceedings and to put the event on record. Mr. A. W. Beuttell, who presided, gave a helpful introductory address in which he pointed out that an illuminated sign almost inevitably gives rise to controversy, because it is both popular and unpopular—popular with some but unpopular with others. It is, however, a public problem, and one that is not likely to be settled if the interested parties continue to work behind closed doors or in watertight departments.

Subsequently there were four speeches, by Mr. John Langdon, Mr. C. J. Rose, Mr. Ian McLaren, and Mr. Humphrey Baker respectively, voicing the views of the sign maker, the advertiser, the architect, and the "Scapa" (Society for Checking Abuses in Public Advertising), all of whom made lively contributions in which the difficulties in arriving at a common understanding were pointed out. There were frequent references to the difficulty in inducing the wolf to lie down with the lamb. (It was Mr. Humphrey Baker, we think, who at one stage in the proceedings endorsed this belief, but remarked incidentally that "he was not the wolf!") But in the end, after the members of the audience had joined in, they relented and supported a resolution in favour of exploring the possibilities of co-operation, which was moved by Mr. W. J. Jones (chairman of the Commercial Lighting Section) in his concluding address.

# Air-Cooled High Brightness Mercury Vapour Lamps and their Application to Projection

Summary of a Paper read by Mr. V. J. Francis and Mr. G. H. Wilson, of the Illuminating Engineering Society on April 18, 1939

The projection of light involves concentration of light for one of three purposes, i.e., to produce on an object a higher illumination than would be derived from the bare source alone (as with a floodlight or searchlight), to provide a distant visual indication (as with a signalling projector) or to project a real optical image of an object in the projector (as with an optical lantern or film projector).

The light-source is an essential part of any projector. There has always been a popular opinion that a "point source" is required for effective projection, but there is probably no optical system for which a point source is essential. The most valuable characteristic, in many cases, of a source is *high brightness*, and this is usually, but not necessarily, found in sources of small dimensions

The beam-intensity, or flux per unit solid angle leaving a projector, is the product of the brightness of the image of the source, and its area as formed in the final aperture and seen from the object illuminated. The brightness of the image is equal to that of the source, less the transmission losses of the optical system. In shape the image is often so distorted as to be unrecognisable, and is usually referred to as "the flashed area." Once the aperture is fully flashed the beam intensity depends solely on the source-brightness. But there are types of projector in which it is impossible to flash fully the final aperture (in a lantern the image-forming objective lens) and size of source as well as brightness is then of importance.

### Brightness of Various Sources.

Amongst available light sources, Tungsten Filament G.L.S. Lamps yield 100-1,000 stilb.*; Tungsten Filament Projector Lamps 250-2,000; the Pure Carbon Arc 10,000-25,000; and the High Intensity Carbon Arc 50,000-100,000. There is an evident need for sources which combine the high brightness of the arc with the simplicity of the filament lamp. This condition is largely met by the new Air-Cooled High-Pressure Mercury Vapour Lamp (H.P.M.V.), which is the subject of study in this paper.

The distribution of brightness across the column of vapour of a 125-watt H.P.M.V. discharge lamp is much less uniform than in the case of a filament. On the other hand, the arrangement of filaments in a projector lamp, in the form of a grid, gives rise to alternate bright and dark regions in the image, so that the average brightness in this case is also less than that of the filament.

Throughout the paper "brightness" means maximum brightness, as found at the centre of the mercury arc; the average or effective brightness is about 0.8 of this value.

During the last year 80-watt and 125-watt H.P.M.V. lamps for general lighting service have become familiar. Although not specially designed for purposes of projection a brightness of 1,000 Sb. is attained in the discharge column of these lamps. By progressively increasing the watts dissipated per sq. cm. of luminous surface the brightness can be considerably increased—and the process can be carried to higher limits than is possible in the case of a filament. The object is achieved both by increasing the current flowing and by preventing the discharge from "spreading," i.e., by using a high pressure of mercury vapour and a narrow bore tube.

* Candle-power per sq. cm.

### The "Compact Source" H.P.M.V. Lamp.

Two types of lamps were illustrated, the linear type such as is designed for aerodrome floodlighting and the 500-watt "compact source" H.P.M.V. lamp, having an arc length of only a few millimetres. The watts per sq. cm. can be made so high with this type of lamp that brightness of the order of 10,000-50,000 candles per sq. cm. can be readily obtained A feature of such lamps, of some importance in connection with the projection of films and lantern slides, is the increased percentage of red in the spectrum which advances as the watts radiated per sq. cm. are raised. This compact source lamp can be used both on A.C. and on D.C. circuits. It operates at a mercury pressure of about 15 atmospheres. The possibility of a burst should be remote, but the housing usual for a projector acts as a protection.

The use of fluorescent powders to improve the colour cannot be easily applied, because such materials only operate efficiently when the temperature is relatively low. Some other methods of improving the colour of the light, such as the addition of cadmium, etc., to the discharge, involve loss in efficiency. Yet other possibilities are the inclusion of an incandescent body in the arc stream and the superposition of an image of the arc on to a tungsten filament. These possibilities are still in the experimental stage.

### Application to Projectors.

In the next section of the paper the authors discussed the application of these lamps to projectors. Dealing first with pencil-beam projectors of the reflector type, it was shown the substitution of a H.P.M.V. lamp with a source-brightness of 20,000 Sb. in place of a grid tungsten filament (1,000 Sb.) yielded a candle-power twenty-seven times as great, which is more than the ratio in brightness would alone suggest, and is explained by the fact that a greater proportion of the mirror was flashed.

In the case of projectors of the lens type the higher luminous and photographic efficiency of the mercury lamp and the lesser heating effect of the beam are again advantages. An illumination on the face of 2,000 ft.-c. from a tungsten filament lamp, corresponding to a temperature rise of 5° C., produces marked discomfort after a few minutes. With a mercury compact source lamp as much as 6,000 ft.c. could be endured without discomfort. In the case of fan beams, such as are developed in trough mirror aerodrome floodlights, the considerations governing the design of the lamp are somewhat complicated, but it is found that for a given watt input maximum intensities 50 per cent. or more above those obtained from tungsten filament lamps can be secured.

### Optical Lanterns and Film Projectors.

Turning next to the ordinary lantern slide projector it is shown that, assuming that images both of a grid tungsten filament and of the arc of a compact source H.P.M.V. lamp are formed within the area of the objective, the gain in illumination will be the same as the ratio of the luminous efficiencies, i.e., about 2½ times. However, there is a further possible gain with the H.P.M.V. lamp because an optical system with an objective lens of smaller aperture can be used. Large diameter objectives can be used more efficiently with the compact source lamp if a shorter focus condenser (e.g., a triple lens condenser) is adopted. It is possible by this means to double the screen illumination. The lamp is, however, very close to the back component of the condenser and

mechanical considerations make it difficult to secure any further advantage.

There is another advantage, unrelated to source brightness and efficiency—the enhanced sharpness of definition which appears to result from the use of the compact source lamp. The exact explanation of this effect appears to be in doubt, but it is possible due to the "stopping down" effect arising from the small dimensions of the image.

The optical system of a film projector does not differ in principle from that of the lantern slide projector, but greater magnification is required and the objective lens is therefore of shorter focus. The image of the source is now formed at or near the film itself rather than on the objective lens. Various illuminating systems are used. With each system the objective lens appears fully flashed from the screen so that projector intensity and screen illumination are proportional to the source-brightness.

With a compact source lamp having a brightness of 20,000 Sb. and an objective of 5cm. diam. an intensity of 228,000 candles (or with the rotating shutter running, 114,000 candles) may be expected. An illumination of 3 ft.-c. would still be produced with a long throw of 200 ft. The lamp would give an illumination twenty times as great as that derived from a tungsten filament lamp or about a quarter that from a high intensity arc of brightness 80,000 Sb.

In the case of smaller projectors for 8, 9.5 and 16 m.m films the optical system often approaches more nearly that of the lantern slide projector, so that the resultant screen illumination is proportional to the light output of the lamp, i.e., it is about 2½ times as great with the compact source mercury lamp as it is with the tungsten grid filament.

### Colour of Light.

When coloured films or slides are projected with a compact source lamp red and near red colours are dulled. With films processed for daylight or for an arc source (e.g., Dufaycolor and Technicolor) the view has been expressed that if black-and-white films are usually projected and colour films only occasionally the colour distortion is not sufficient to matter. The addition of a yellowish red filter improved the colour rendering, but more satisfactory results were obtained when the red ratio of the light from the lamp was improved, and still more when this device was combined with the filter. A drawback is the loss of light by absorption, but a similar absorption is occasioned by the blue filter adopted, with the processes named, for tungsten lamps.

### Miscellaneous Applications.

Amongst miscellaneous applications reference is made to the projection miscroscope and the spot of light in an oscillograph or sound recorder. Actual tests on a projection microscope have shown an image illumination twenty-three times as great with a compact source lamp as with the Pointolite lamp. The definition should also be better. In the case of other applications, as in other instances where a small mirror is completely flashed by the image of the source on it, twenty times the illumination obtainable from a tungsten filament lamp may be expected.

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## Lighting and Architecture

In a discussion before the North-Western Area I.E.S. Local Centre in Manchester on March 15, Mr. H. Elder, speaking from the architect's standpoint, recalled the appreciation of natural light shown by the ancients and revealed in Grecian classical and Gothic architecture. Progress in artificial lighting had been surprisingly slow, being hampered by the dominant influence of tradition—not that knowledge gained from tradition was necessarily detrimental, provided it was not misapplied. The tendency to reserve the centre of the room for the lighting unit was clearly due to the influence of the gas pendant or oil lamp. Yet he would not suggest that artificial light should be expected to compete with daylight. (Beware of the person wanting to sell you shadowless lighting for decorative effect—life is flat enough at the present time without taking all the sparkle away!)

In times past it was said that Society set the style—not that Society set anything, but it certainly paid the progressive artist of the day to execute work. Who to-day takes their place in the development of lighting?

Mr. Elder criticised the lighting of various leading buildings in Manchester, such as the Cathedral and in the Free Trade Hall, where it served to distract attention and remove the eye from its focal point. It seemed that the only serious opportunity for experimentation in lighting was the cinema.

Mr. Elder also commented on the poor design of many fittings of the present day. Was it not possible for a council to be set up to approve the design of fittings before sale to the public? To-day there were many materials available, but they were used in very limited ways, whereas the ancients had few materials but used them to better advantage.

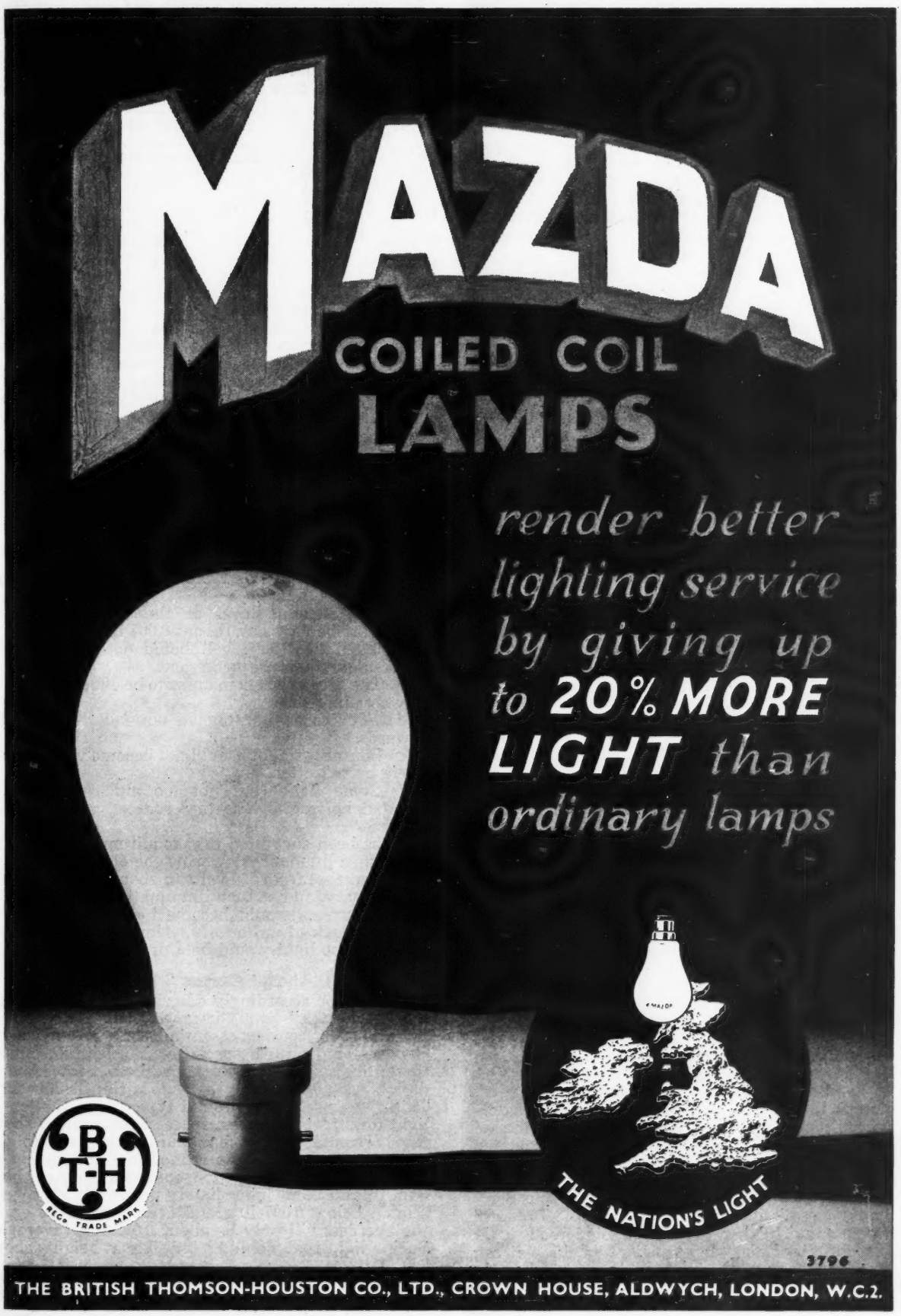
Architects aimed at the encouragement of appreciation of beauty, and asked for more co-operation from the engineer, who should recognise that his lighting should be an efficient part of the general design, not dominant, but part of the experimental whole.

Mr. L. M. Tye, expressing the view of the illuminating engineer, endorsed the need for sympathy and collaboration from the architect in lighting matters. His ideas in regard to treatment should be made clear, so that the lighting engineer could develop them in schemes that were practicable and efficient. The Decorative Lighting Section of the I.E.S. had already proved helpful in paving the way for this liaison.

When new buildings were erected it was vital that the architect should interest himself in the lighting from the start. Too often consideration of details was postponed until a contractor was asked to wire the completed building—by which time the construction was so far advanced that a free hand was no longer possible. The architect's treatment should be influenced by modern lighting developments. Instances of new churches and similar buildings in which highly novel methods had been introduced were mentioned. In the theatre and the cinema the utilisation of concealed lighting and indirect methods in conjunction with moulded contour schemes had had very happy results, and enabled harmonious and pleasing effects to be gained without the need for elaborate decorative treatment.

Turning again to the lighting of churches, Mr. Tye suggested that this was a case in which conditions approaching those characteristic of daylight might be desirable, in order that the architectural beauty of the interior might be truly rendered. Yet such methods often excited opposition both from architects and ecclesiastical bodies. A clear expression of opinion on these and other problems seemed desirable. The same applied to floodlighting. Spectacular schemes which seemed attractive to the lay mind were apt to be criticised form the architectural standpoint. As floodlighting was being applied so habitually to outstanding buildings, it did seem necessary that the architect should co-operate in this field and ensure progress on the right lines.

In conclusion, Mr. Tye referred to the influence of lighting on modern architecture, mentioning the ideas of the late Dr. Teichmüller and the incorporation of lighting equipment in walls and ceilings. He emphasised, however, that these ideas should have allied to them scientific methods of light-direction. Otherwise they were apt to prove unduly wasteful and inefficient.


MAZDA
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render better
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by giving up
to 20% MORE
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THE BRITISH THOMSON-HOUSTON CO., LTD., CROWN HOUSE, ALDWYCH, LONDON, W.C.2.

# Illumination and "Black Outs"

There has been a considerable amount of discussion amongst illuminating engineers in regard to methods of lighting during war conditions. It will be recalled that this topic figured in the A.P.L.E. programme at Bournemouth last year. Some concern has been expressed at the idea that it would be possible to manage with literally *no* lighting in the streets, but lighting experts at present lack one fundamental factor on which modified lighting arrangements might be planned—a definite and authoritative statement in regard to the permissible brightness of objects seen from above.

In an instructive contribution by P. J. Bouma, in the "Philips Technical Review" (January, 1939, p. 15), this problem is approached from a new standpoint. It is remarked that accurate information about the visibility of light spots of different sizes and degrees of brightness, under conditions which would hold for an observer in an aeroplane during an air raid, are most difficult to obtain. Mass observations from above would be necessary, and actual war conditions cannot be simulated. In such tests the observer will usually fly over well-known country; also, the psychological factor will be different.

### Estimates of Visibility of Objects.

Nevertheless, there is available a large amount of observational material, collected in laboratories, in regard to the visibility of objects of various sizes and brightnesses. In the original article the author assembles data obtained by six different investigators. He plots the average in the form of a curve giving the illumination, $E$, which a circular object must give to the eye, in order to be clearly visible, as a function of the size of the object. The data show remarkable agreement. With very small angles of vision $E$ is independent of the solid angle $\alpha$ subtended at the eye. Total light intensity rather than brightness is, then, the important factor. With very large angles (i.e., above about 10°) $E$ is proportional to $\alpha^2$, i.e., to the apparent area. In such cases it is *brightness*, and not area that determines the visibility. For very small angles of vision the threshold is $E=10^{-9}$ lux; for very large angles of vision $B=3.4\times10^{-10}$ stilb*. In practical navigation a threshold value of $2\times10^{-7}$ lux† is adopted for small angles of vision—a value approximately 200 times that observed in the laboratory. This difference may seem surprising until certain points are recalled, e.g., that with laboratory experiments the eye is usually completely dark-adapted, it is known where the light point is to be expected, there is unlimited time for observation and it is possible to concentrate one's attention calmly on the visual observation—all conditions not found under practical conditions.

It must be remembered, however, that in the case of a black-out the requirement is that the light shall just *not* be visible, whereas in navigation the condition is that it shall be just visible. Taking this into consideration, it is suggested that threshold values for the black-out problem may be obtained fairly accurately if we multiply values of $E$ by a factor of 100

For very large illuminated surfaces we thus derive a max. permissible brightness of $3.4\times10^{-8}$ stilb. If we assume further that the lighted road-surface has a diffusely reflecting coefficient of 15 per cent. (typical of block granite and much greater than that usual for asphalt), this means a maximum permissible illumination of $7\times10^{-3}$ lux. For light-sources in the form of a point $E$ is about $10^{-7}$ lux for the eye. An intensity of 1/10 of a candle may, under favourable conditions, be observed at a height of one kilometre. It is, therefore, of primary importance that light-sources should not radiate any light upwards

* Candles per sq. cm.

† 1 lux may be taken as approximately equal to $\frac{1}{10}$ ft.-c.

### Maximum Illuminations Permissible.

The following table shows the maximum illumination that circular spots of specified diameter may have in order that they shall not be observed at heights of 300, 1,000, and 3,000 metres, assuming an average coefficient of reflection of 30 per cent.:—

| Height (Metres) | Permissible Illumination with Objects of diameters (metres):— 0.1 | 1 | 10 | 100 |
|---|---|---|---|---|
| | lux | lux | lux | lux |
| 300 | 14 | 0.26 | 0.013 | 0.0041 |
| 1,000 | 135 | 1.9 | 0.051 | 0.0057 |
| 3,000 | 1,200 | 14 | 0.26 | 0.013 |

The table shows that an illumination of 1 lux (about the lowest illumination at which it is possible to read) is permissible with a height of plane of 1,000 m. when the light spot has a diameter of 1 m., but for much larger areas this illumination becomes quite inadmissible. For very large areas (above 100 m.) visibility decreases only slowly with increasing height, but small light spots (about 1 m.) disappear very quickly as the plane rises. The window of a well-lighted room (100 lux) which has an area of 0.8 sw. sq. sq. m. must be provided with a curtain that allows not more than 2 per cent or $\frac{1}{4}$ per cent. of the light to pass if it is to be made invisible at 1,000 and 300 metres distance respectively.

### Guiding Principles.

Consideration of this table suggests the following guiding principles.

(a) The general level of the outdoor illumination must be very low (about 0.007 lux).

(b) Even this low level should not be used over larger areas than are necessary.

(c) The illumination, in order to be effective, should be very uniform.

(d) Sources of light should not radiate any light upwards.

(e) Sources of light should not become visible from above by reflection.

(f) Some light (but not too much) should be radiated horizontally so that sources may serve as beacons.

It has been suggested that requirement (a) might be satisfied by merely lowering the electric pressure. But a decrease from 220 volts to about 35 volts would be necessary, and at such illuminations the visibility in most streets would become too poor because of the great lack of uniformity. Moreover, the reddish colour of the light would be a drawback.

### The "Protector" Lamp.

The author accordingly describes a special device, the "Protector" lamp, designed to meet the above conditions. It consists essentially of a 25 w. vacuum electric lamp with a specially shaped bulb, almost the entire surface of which has been sprayed with dull black paint. Only a narrow ring is left free. This gives rise to the desired type of distribution of light for streets and open spaces with no light above the horizontal and a maximum near sixty to the vertical. If such a lamp is mounted at a height of four metres the illumination, outside a circle of about 6 m. from a point immediately under the lamp, will remain below 0.007 lux, and even within the circle the average will only be about 0.012 lux (average). Such a light spot would be invisible at heights above 300 metres.

Another type of lamp, of somewhat similar design, but intended for indoor lighting, and having an appropriate distribution of light, with the maximum below the lamp, has also been devised. The use of this does not make the use of curtains unnecessary, but it makes it possible to obtain a satisfactory black-out in

*Advertising*

# ELECTRIC *street lighting*

## *is like preaching to the converted*

***It is, therefore, sufficient to remind Public Lighting Authorities of no more than three facts:–***

**1** **38.8 millions* more units of electricity were used for street lighting in 1937-38 than in previous years—an increase of nearly 13%**

**2** **Every £ buys 30% more electricity for public lighting than it did in 1932**

**3** **Every unit can produce over twice as much light as it did ten years ago**

* *Figures taken from Electricity Commission Annual Return, 1937-38, just published*

***Progressive lighting authorities recognise that modern street lighting is***

# ELECTRIC

*All those responsible for public lighting are invited to apply for a copy of "Electric Street Lighting" to the British Electrical Development Association, 2 Savoy Hill, London, W C 2*

spite of the imperfect shading often afforded by ordinary curtains. Practical experience with lamps of this type during various black-out tests has confirmed these conclusions. They would be used during the whole time of possible danger as it is impossible to change lamps quickly when an air raid is imminent.

**Choice of Colour of Light.**

There has been much discussion on the advantages or drawbacks of using coloured light. On the whole, the author suggests that blue light, which gives an effect not widely different from star light and for which peripheral vision is specially sensitive, may have advantages; red or deep yellow coloured light, such as tends to stand out at a distance because of the unusual colour, would not be chosen.

## Stage Lighting for Schools and Colleges

It is difficult to say precisely how many amateur dramatic societies there are in this country but the number must run into thousands. A little booklet issued by the Strand Electric and Engineering Company, Ltd., is therefore timely. It outlines the requirements for stages in schools, colleges, and institutes, where simplicity and inexpensiveness are often considerations of moment. The lighting equipment desired may be included under the headings of footlights, battens, flood lanterns, focus lanterns (spotlights), stage plugs (dips), and switch and dimmer control. Each of these items is dealt with in turn and illustrated by sketches. At the end of the booklet several examples of installations are discussed and the nature of the equipment and its application illustrated by diagrams.

## Bikker's Controlled Light Equipment

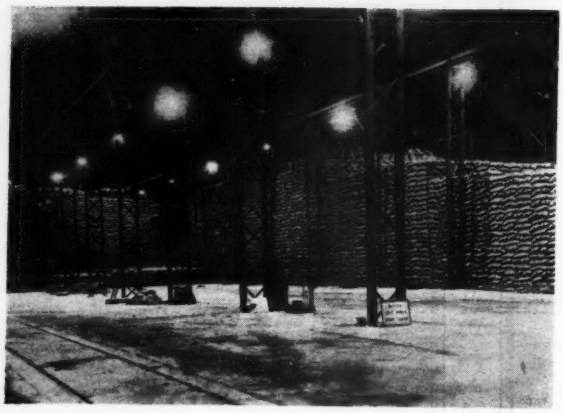
Our attention has been drawn by Mr. R. J. Mackay to the above system, which is claimed to have special advantages in relation to A.R.P. The principle involves the use of several successive black-lined chambers, which may be of long tubular form disposed coaxially, and which are very effective in eliminating any stray light. This is exemplified in the Bikker torch, which yields a very narrow beam, can be fitted with four colours for signalling, and is equipped with a device for extinguishing the light if the torch is inadvertently pointed upwards. This is specially suitable for use by air wardens. Other devices such as the controlled vehicular and rear lamps have been the subject of experiment in official black-outs in Holland, when it was found possible for traffic to proceed in convoy form at twenty to twenty-five m.p.h., notwithstanding the fact that no light was visible upwards—either directly or by reflection off wet roads. Special industrial units have also been evolved for use in factories, and have been installed in important Dutch clothing and munitions factories, where the glass is not obscured, but where, nevertheless, there is no light visible from overhead. Experiments were also made recently at the factory of Messrs. Lyons, at Greenford. Tea-packing machines were run for an hour by the light of these units without strain or discomfort to operatives, whilst observers on neighbouring roofs were unable to detect any light from the saw-tooth roof glass of the shops in question.

## Contracts Closed

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD.—*Post Office Stores, Great Western Railway,* and *London and North Eastern Railway*: For the supply of Siemens British-made electric lamps.

GENERAL ELECTRIC COMPANY, LTD.—*Botley Park Colony*: 4,000 Osram lamps and a large amount of G.E.C. electrical equipment. *Police Stations (Bishopsgate and Compton-place, London)*: Osram lamps and G.E.C. fittings. *Birmingham Airport*: Floodlighting equipment. *Hove Corporation*: 2,400 15 watt Osram lamps for pier and promenade lighting, also a large quantity of fairyland strip. *Plymouth Corporation*: Fifty steel columns and Wembley street lighting lanterns.

## Lighting in a Sugar Factory



The above picture shows the lighting of a sugar factory at Peterborough with Ediswan 400-watt Escura mercury discharge lamps in dispersive reflectors and distributing lanterns fitted with well glasses. It is a good example of overhead lighting with sources placed well out of the normal range of vision. The units are mounted 38 ft. high with a spacing of 50 ft.

## The Ediswan Lamp Museum

When this collection was inaugurated at the Ediswan premises in Charing Cross-road on November 14 last year it comprised Edison and Swan lamps dating from 1878 (when Sir Joseph Swan made the first practical incandescent lamp) up to date. A new section, including specimens of other outstanding inventions of early lampmakers, has now been added at the cost of much time and money.

Among the lamps thus acquired are specimens of The Metropolitan Brush Company, Woodhouse and Rawson, "Sunbeam," Weston, Maxim, Crookes, Lane Fox, Cruto, and "Tantalum." Of these the Cruto lamps and the Crookes lamp are of outstanding interest. The Cruto lamps are three of the five believed to be the only examples of this inventor's work now in existence; they are the hollow filament type of 1882/4. The Crookes lamp is a splendid example of the tubular globe employed by Sir William Crookes.

Efforts are still being made to acquire lamps by other manufacturers and inventors. Of many early lamps not a trace can remain since no more than one or two specimens were made. But records of every one of them exist still, and from such records Ediswan intend to compile a "Roll of Honour," giving the names of the inventors, a brief specification, and, where possible, a sketch of the lamp as it would have appeared. In this way every lamp ever patented in Great Britain will be represented in the Museum, if not by an actual speciment of the lamp, at least by description.

## "Anolier" Reflectors

In view of the recent growth in popularity of indirect light, the Benjamin Electric, Ltd., have introduced two new units under the name of Anolier reflectors, which combine high lighting efficiency with most pleasing appearance. These fittings take advantage of the larger output of the bigger size lamps, and they will accommodate lamps from 200 watts up to 1,000 watts. The light is spread very widely over the ceiling, allowing a spacing of five to one for even illumination, and as most of the light control is effected by the lower cup, which is easily removable, it is extremely easy to clean and to renew lamps without having to climb above the fitting. A simple arrangement enables a small proportion of the light to illuminate the lower side of the main reflector, so providing a light appearance to the unit. The fittings are made of aluminium with Ali-Tal anodised finish which preserves and brightens the metal. Benjamin leaflet No. 1630 gives full particulars.

# Public Lighting by Electricity

*West Ham.*—An additional mile and a furlong of main highway in West Ham is shortly to be lighted by 400-watt mercury discharge lamps in bowl refractor lanterns. Advantage is being taken of the trolley-bus poles which have recently been erected, and the lighting equipment will be supported on extension bracket arms. At the present time, 20.43 miles of road are lighted by mercury discharge lighting, of which 16.8 miles is carried out with 400-watt lamps and 3.63 with 250-watt lamps.

*Wimbledon.*—Hartfield-road, an important bus and traffic route which by-passes the busy Wimbledon shopping centre, has been lighted by 140-watt sodium lamps in refractor lanterns spaced 121 ft., 26 ft. high, with 4 ft. overhang.

*Hemel Hempstead.*—Sodium discharge lighting at 25 ft. mounting height is to be provided in Marlowes and High-street, Hemel Hempstead.

*Battersea.*—Public lighting in Lombard-road and Vicarage-crescent is to be improved by the provision of seventeen mercury discharge lamps erected on tall steel columns.

*Sunderland.*—The A.R.P. Committee has arranged for a demonstration of centralised control equipment which, if satisfactory, will be utilised to control street lighting throughout the town, twelve "alarm" and "all-clear" sirens, and to provide A.R.P. workers all over the town with the necessary signals. The system, if approved, would simultaneously operate the whole of Sunderland's 4,000 electric street lamps, and will be the largest scheme in operation in the country.

*Chester-le-Street, Co. Durham.*—In April the introduction of electric lighting at Chester-le-Street will commence as a result of a ten-year agreement entered into by the Urban District Council. The annual cost will amount to £1,834, which involves a saving on lighting expenditure of a 3d. rate.

*Windsor.*—Capital expenditure of £4,130, with annual maintenance costs amounting to £1,296, are involved by a recent decision of the Windsor Council to improve street lighting. The new lighting will be carried out by mercury discharge lamps at a mounting height of 25 ft., the whole work being carried out in accordance with the recommendations of the M.O.T. Final Report. The Council propose to spread the work over a period of three years.

*Amersham.*—Experimental lighting is being adopted in Hill-avenue and at Oakfield Corner. Fluorescent 80-watt mercury discharge lamps, supported by 125-watt lamps, will be installed.

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## SITUATION DESIRED

**Young assistant illuminating engineer, experienced in the design of industrial, street lighting, and decorative equipment, requires progressive position. Box No. 444.**

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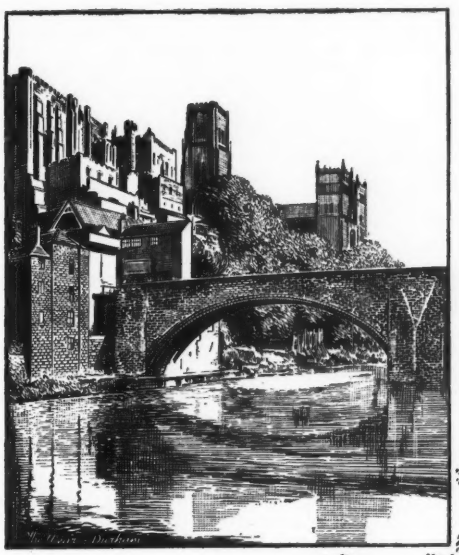
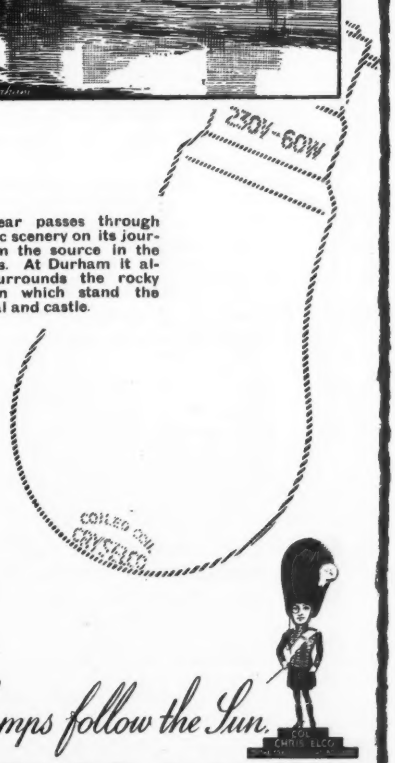
# Lighting in a Laundry

The above picture shows the lighting adopted for the new laundry of Messrs. C.W.S., Ltd. (Clay Lane, Birmingham). This is carried out with electric gasfilled lamps in the new Revo "Saferlite" reflectors, which are provided with a patent type for their instantaneous release. The picture gives a good idea of the high and even illumination provided.


*Beautiful Waterways*



The Wear passes through romantic scenery on its journey from the source in the Pennines. At Durham it almost surrounds the rocky cliffs on which stand the cathedral and castle.




*Cryselco Lamps follow the Sun*

**CRYSELCO LAMPS**

CRYSELCO LTD., KEMPSTON WORKS, BEDFORD AND HOME BRANCHES

# Literature on Lighting

## (Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

*(Continued from page 80, April, 1939.)*

### I.—RADIATION AND GENERAL PHYSICS.

**113. Spectral Distribution of Solar Radiant Energy.**
*H. P. Gage.* Am. Illum. Eng. Soc. Trans., 3, pp. 316-329, March, 1939.

Data is presented on the spectral distribution of solar energy at the earth's surface for wet and dry days, with an elevation of the sun at 30 deg. and 57 deg. The data should prove useful in calculating the total energy transmitted by heat-absorbing glasses. J. S. S.

### II.—PHOTOMETRY.

**114. Brightness Meter.**
*M. Luckiesh and L. L. Holladay.* Magazine of Light, VIII., No. 2, p. 4, March, 1939.

Details are given of the new Luckiesh-Taylor brightness meter. C. A. M.

**115. The Principles and Conventions of Colorimetry.**
*P. Fleury.* Rev. d'Opt., Vol. 17, No. 10, pp. 337-348, October, 1938.

A detailed summary of the principles of colorimetry is given, together with a full explanation of the trichromatic co-ordinate notation. R. G. H.

**116. Terminology and Standards of Illumination.**
*E. C. Crittenden.* J. Opt. Soc. Amer., Vol. 29, p. 103, March, 1939.

Summarises the present status in the choice of technical terms and their precise definition. F. J. C. B.

**117. Illumination Calculations.**
*Parry Moon.* J. Opt. Soc. Amer., Vol. 29, p. 108, March, 1939.

It is pointed out, in dealing with this subject, that the theory used by most illuminating engineers to-day is thoroughly antiquated and makes very little use of the field of concept which has proved so valuable in other branches of physics. New methods of approach to many illumination problems are given. F. J. C. B.

**118. The Behaviour of Vacuum Photocells under High Light Intensities and with High Voltages Across them.**
*H. Krüger and F. Weidert.* Zeits für Techn. Physik, No. 2, pp. 50-55, February, 1939.

Cæsium and potassium photocells were subjected to very high light intensities and to voltages up to 1,000 volts, and the departures from linearity noted. The varying performance of cells under prolonged exposure to high intensities is also discussed. A. E. S.

**119. Comparative Incandescent and Mercury Lighting Tests Reveal Correct Interior Paints.**
*Anon.* Am. Illum. Eng. Soc. Trans., 3, p. 237, March, 1939.

A table is given showing the reflection factors of twenty-one typical painted surfaces for light, from a 250-W. high-pressure mercury vapour lamp and a medium wattage filament lamp. In general, the difference is small, but white or near white colours reflect slightly more light from the mercury vapour lamp, while the reverse is the case with red and orange tints. J. S. S.

### III.—SOURCES OF LIGHT.

**120. The Operating Characteristics of Incandescent Lamps.**
*E. W. Beggs.* J. Opt. Soc. Amer., Vol. 29, p. 117, March, 1939.

Gives a brief report on recent improvements in the design of filament lamps. F. J. C. B.

**121. High Efficiency Mercury and Sodium Vapour Lamps.**
*L. J. Buttolph.* J. Opt. Soc. Amer., Vol. 29, p. 124, March, 1939.

Details are given of the design, operating characteristics, and spectral output of a number of new types of lamp. F. J. C. B.

**122. Daylight Fluorescent Lamps.**
*A. H. Taylor.* Magazine of Light, VIII., No. 2, pp. 13-15, March, 1939.

A comparison with natural daylight is made of new American Daylight fluorescent lamps. Relative energy and luminosity data are given. C. A. M.

**123. The Basis for High Efficiency in Fluorescent Lamps.**
*R. N. Thayer and B. T. Barnes.* J. Opt. Soc. Amer., Vol. 29, p. 131, March, 1939.

A general description of the lamps and their luminous and electrical characteristics is given, together with the spectral distribution of the visible radiation from various phosphors excited by certain mercury lines. F. J. C. B.

**124. Mazda Fluorescent Lighting.**
*Matthew Luckiesh.* Magazine of Light, VIII., No. 2, pp. 22-24, March, 1939.

The potentialities of the new American fluorescent tubular lamps are discussed. C. A. M.

**125. Power Factor.**
*Ward Harrison.* Magazine of Light, VIII., No. 2, pp. 7-9, March, 1939.

An attempt is made to describe the power factor of discharge lamps in simple terms by means of a mechanical analogy. C. A. M.

**126. Two New Synchro-Press Photoflash Lamps Announced.**
*Anon.* Am. Illum. Eng. Soc. Trans., 3, p. 241, March, 1939.

A description is given of two new photoflash lamps for Press photographic purposes. The first, "Synchro-Press No. 11," is foil-filled, and the second, "Synchro-Press No. 16," is wire-filled. Long duration of flash, uniformity of timing, and strength are among the advantages claimed. J. S. S.

**127. Self-reflecting 25-W. Show-case Lamp.**
*Anon.* Am. Illum. Eng. Soc. Trans., 3, p. 242, March, 1939.

A tubular lamp, 5⅝ in. long, having an aluminised reflecting surface over half the interior of the bulb, is described. It is claimed to produce two to three times the effective illumination given by a normal, clear tubular lamp. J. S. S.

### IV.—LIGHTING EQUIPMENT.

**128. Lighting Designs.**
*Anon.* Elect., 122, pp. 403-404, March 31, 1939.

Details and photographs are given of a number of new lighting units now on the market. C. A. M.

**129. Indirect Luminaires, Efficient and Inefficient.**
*Ward Harrison.* Am. Illum. Eng. Soc. Trans., 3, pp. 255-270, March, 1939.

This paper compares various indirect lighting fittings from the point of view of efficiency and comfort. Three systems, in which special ceilings form an integral part of the lighting scheme, are described. J. S. S.

**130. An Arc Mechanism with Magnetically Operated Upper Electrode.**
*J. v. Calker.* Zeits. für Techn. Physik, No. 2, pp. 55-56, February, 1939.

A new mechanism for operating arcs magnetically is described, and the advantages of this over other methods are outlined. A. E. S.

**131. Condensers in A.C. Circuits for Discharge Lamps.**
*H. Strauch.* Zeits. für Techn. Physik, No. 3, p. 67, March, 1939.

The author discusses oscillograms obtained from discharge lamp circuits when the condenser is fitted in different places in the circuit, and shows that in certain cases the amount of stroboscopic effect can be influenced. A. E. S.

## V.—APPLICATIONS OF LIGHT.

**132. Light and Architecture.**
*Anon.* Am. Illum. Eng. Soc. Trans., 3, pp. 247-254, March, 1939.

Some representative architectural lighting schemes are described, with photographs.

**133. Office Lighting.**
*Anon.* Elect., 122, p. 482, April 14, 1939.

Details, with photographs, are given of two office lighting installations using indirect lighting principles. C. A. M.

**134. Diverse Units Light New Service Building.**
*R. B. Brown.* El. World, 111, p. 298, January 28, 1939.

A description (with photographs) is given of the lighting of a large service building and warehouse. Different forms of units are used, some being simple filament lamp fittings, and some combination filament and mercury vapour lamp fittings. In one section filament and mercury vapour lamp units are placed alternately. S. S. B.

**135. Load Centre Transformers Aid Factory Relighting.**
*W. J. Leemhuis.* El. World, 111, p. 273, January 28, 1939.

As the incandescent filament lamp is generally the equipment in a factory circuit most sensitive to voltage fluctuation, it is sound economy to locate the distribution transformers as close as possible to the load centres to obtain good lighting at minimum cost. Taking an actual case, the costs for three different plans were worked out. The scheme using the minimum length of secondary circuit was found to be the most economical, despite higher cost for transformers. The use of induction regulators, in addition, maintained the voltage at lamp sockets within 1 volt for wide variations of general load. S. S. B.

**136. Practical Aspects of Luminous Store-fronts.**
*H. M. Alexander.* Am. Illum. Eng. Soc. Trans., 3, pp. 297-315, March. 1939.

The paper discusses the design and installation of lighting systems for shop windows and façades. The advantages and disadvantages of various translucent materials for this purpose are compared. J. S. S.

**137. Industrial Lighting.**
*Anon.* Elect., 122, p. 414, March 31, 1939.

An outstanding feature of the new lighting equipment of a works at Gateshead-on-Tyne is the special design of a fitting for shadowless illumination for drawing office work. The fitting has a large rectangular base with a 150-watt bowl silvered lamp. Values of 25 ft.c. are obtained on the drawing board. C. A. M.

**138. Factory Lighting.**
*Anon.* Elect., 122, p. 378, March 24, 1939.

Details are given of the lighting equipment of a silk works in which 80- and 125-watt mercury discharge lamps are extensively used. C. A. M.

**139. Lighting Methods for Power Presses.**
*Anon.* El. World, 111, p. 890, March 25, 1939.

The requirements for adequate lighting of power presses are discussed, those for small presses being slightly different from those for large presses. A system using both general overhead and supplementary localised lighting is recommended. General values of illumination and forms of light distribution are presented. S. S. B.

**140. The Influence of General Lighting on Machine Shop Tasks.**
*H. M. Sharp and C. L. Crouch.* Am. Illum. Eng. Soc. Trans., 3 pp. 271-296, March 1939.

The paper discusses the relative merits of several common general lighting systems, supplementary local lighting being absent. Tests indicate that all systems in common use

1. Fail to reveal detail properly;
2. Give rise to high lights of objectionable brightness;
3. Emit sufficient flux towards the eye of the worker to cause a reduction in the ability to see.

The authors conclude that while local lighting is necessary, a great deal remains to be done in improving general lighting systems. J. S. S.

**141. Brass Rolling Mill Uses 20 ft.c.**
*Anon.* El. World, 111, p. 731, March 11, 1939.

A mixture of mercury vapour and tungsten filament units has been used in the lighting of a brass rolling mill. Excellent colour characteristics are claimed. Clear glass cover plates are used with the reflectors to reduce maintenance to a minimum S. S. B.

**142. Multiplane Lighting Assists Pressmen.**
*Henry G. Nichols.* El. World, 111, p. 436, February 11, 1939.

Lithography requires extreme precision in presswork, as spoilage becomes increasingly expensive as later colours are run. Special lighting with four different types of units is used to obtain the best result in the plant described. S. S. B.

**143. Cotton Mill Lighting.**
*R. H. Harral.* El. Rev., Vol. CXXIV., No. 3,202, p. 493, April 7, 1939.

A general survey is given of the problems involved in lighting cotton mills by electricity. R. G. H.

**144. New Fluorescents Aid Fur Sales.**
*Anon.* El. World, 111, p. 593, February 25, 1939.

The use of fluorescent tubular lamps for the lighting of furs is described, the appearance of the furs and the matching of pelts being greatly improved compared with the results under filament lamp lighting. The decrease in heating caused by the lamps is also quoted as an advantage. S. S. B

**145. Unidirectional Road Lighting.**
*Anon.* El. Rev., Vol. CXXIV., No. 3,202, p. 504, April 7, 1939.

Describes, with photographs, a demonstration of a new system of lighting for double carriageway arterial roads. Light is directed towards the oncoming traffic only, so that objects are seen dead black against the bright background of the road surface. A saving in running costs of more than 60 per cent. is said to be effected. R. G. H.

**146. Progress in Sodium-Vapour Outdoor Lighting.**
*S. B. Gaylord.* G. E. Rev., 3, pp. 102-108, March, 1939.

A description is given of installations using sodium vapour lamps for the lighting of roads, tunnels, and other outdoor situations. Some account is given of the fittings and lamps generally used. J. S. S.

**147. A.R.P. Lighting.**
*"Pharos."* Elect., 122, p. 366, March 24, 1939.

The problem of lighting during an emergency is discussed, and some solutions are suggested. C. A. M.

**148. Lighting of A.R.P. Shelters.**
*Anon.* Elect., 122, pp. 309 and 402, March 31, 1939.

Details are given of the lighting system for A.R.P. shelters recently installed at a large works in Essex. A petrol-driven generator is used as the main source of supply, with accumulators as an emergency source. C. A. M.

**149. "The Coronation Scot."**
*Anon.* Elect., 122, p. 465, April 14, 1939.

Details are given of new lighting equipment fitted on the L.M.S. "Coronation Scot" before touring the United States. C. A. M.

**150. 100 ft.c. for Cincinnati Bowlers.**
*F. B. Ausdenmoore.* El. World, 111, p. 446. February 11, 1939.

High intensity lighting has been provided in a Cincinnati skittle alley. A general level of 10 ft.c. is obtained on the runways and 100 ft.c. in the area of the pins. Flush mounted reflectors are used to keep light from the eyes of the bowlers. S. S. B.

# Recent Patents

*(Abstracts of recent Patents on Illumination & Photometry.)*

**No. 499,967. "Improvements Relating to Electric Battery Lamps."**

*The Concordia Electric Safety Lamp Company, Ltd., and Jones, J. W. Dated July* 31, 1937.

This specification describes a miner's or similar battery lamp in which the base plate of the casing is of an area less than the cross-sectional area of the casing and the edges of the base plate are curved outwardly and upwardly as a saucer or a tray to surround the lower part of the casing walls so that the lamp may be easily slid forward by the user without danger of overturning. The handle may be set and locked in any one of a number of angular positions on the lid or cover of the casing.

**No. 500,332. "Improvements in Road Lighting Devices."**

*Concrete Utilities, Ltd., Marques, C. A., and Thomas, F. Dated May* 26, 1938.

This specification describes a standard or bollard for road illumination having a reflecting panel terminated at the bottom by a step in which is a window through which light from a lamp within the base illuminates the panel. When in the form of a light standard, automatic means may be provided to energise the light source within the base and illuminating the panel when the main light source of the standard is extinguished.

**No. 500,367. "Improvements in and Relating to Electric Battery Lamps."**

*The General Electric Company, Ltd., and Richards, S. W. Dated August* 13, 1937.

This specification covers a battery lamp or torch in which a rigid internal liner contains the battery and is designed to resist deformation due to swelling of the cells. The liner may be open at one end and have an inturned flange at the other end. It may have also slots or holes for engagement with a tool to facilitate its withdrawal from the torch.

**No. 500,564. "Improvements Relating to Miners' Electric Lamps."**

*Joseph Lucas, Ltd., and Marlow, F. J. Dated August* 11, 1937.

This specification relates to miners' electric lamps in which a turbo-electric generator, operated by compressed air, is directly combined with a lamp bulb within a glass or other enclosure. According to this specification the air for the turbine passes through an automatic pressure reducing or controlling inlet valve which is equipped with electric contacts controlled by the valve and adapted to short circuit the generator or open the bulb circuit in the event of fracture of the bulb enclosure or failure of air supply.

**No. 500,914. "Improved Electric Incandescent Lamp having a Refractory Incandescent Body."**

*N. V. Philips Gloeilampenfabrieken. Dated February* 25, 1937. *(Convention, Holland.)*

According to this specification an electric lamp comprises an incandescent body made of a material whose melting point exceeds 3,000°K and shaped as a hollow body which forms an opaque envelope of a discharge chamber having such discharge capacity that, in its hottest points, the body radiates energy at, at least, 80 watts per square centimetre. The body is conveniently a cylindrical tube having a convex shape and constitutes an opaque wall of a discharge tube filled with inert gas. It screens the luminosity of the discharge. It preferably is a single crystal of material and may be a semi-conductor such as tantalic carbide or a non-conductor such as boron nitride. It may be internally coated with a heat resisting layer having insulating properties such as thoria. The discharge may be a high-pressure mercury vapour discharge.

**No. 500,969. "Improvements in or Relating to Light Polarising Devices."**

*Armstrong, J. J. V. (Communicated by Robert Bosch A/G.). Dated August* 19, 1937.

This specification covers a polarising device, especially for vehicle head-lamps, in which the light is polarised by reflection at two opposed parallel reflecting surfaces consisting of material having a high polarisation ability and good reflecting power such as chromium, rodium, tungsten, molybdenum, tantalum, nickel, silicon and iron, or a compound such as molybdenum glance. When chromium is used for the reflecting surfaces, the angle between the reflecting surface and the incident beam is preferably 12°.

**No. 501,252. "Improvements in or Relating to Electric Incandescent Lamps and Discharge Tubes."**

*N. V. Philips Gloeilampenfabrieken. Dated July* 12, 1937. *(Convention, Germany.)*

According to this specification an incandescent lamp or discharge tube is provided with means for indicating by a change of colour the number of hours over which the tube or lamp has operated comprising a compound of cobalt with zinc or aluminium, for example, cobalt and zinc oxide or cobalt and aluminium oxide.

**No. 501,794. "Improvements in and Relating to Methods of Illumination and Electric Discharge Lamps Therefor."**

*British Thomson-Houston Company, Ltd. Dated August* 25, 1937. *(Convention, U.S.A.)*

This specification covers a structural wall composed of hollow blocks of light-transmitting material containing ionisable gas and means for rendering it luminous by passage of electric currents therethrough. The blocks may have an internal coating of fluorescent material. They may have internal electrodes or they may have external electrodes and may be excited at high frequency.

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## Public Lighting by Gas

The Ellesmere Port U.D.C. has approved a ten-year agreement for the use of gas lighting in Ellesmere. About 550 lamps are covered by the new contract.

Improvements are being carried out in the lighting of Yeadon, Guiseley, Rawdon, and Hawksworth, which fall within the area of the Aireborough U.D.C. The present contract extends until the end of 1946.

About 1,160 lamps are covered by a renewal of its street lighting agreement by the Burgh of Kirkintilloch.

Ilkley U.D.C. has renewed its contract for gas lighting in Menston.

Over 280 lamps are covered by a renewal of its contract for gas lighting by the Bedwellty U.D.C.

Collingham Parish Council is carrying out improvements in street lighting under a new five-year contract between the Council and the Borough of Newark Gas Department.

Chard Corporation has renewed its agreement for gas lighting in the streets of the borough.

A five-year agreement for the gas lighting of Rothwell has been entered into by the Urban District Council. About 860 lamps are in commission.

The Cirencester U.D.C. has entered into a ten-year contract for gas lighting in its area.

A three-year agreement for gas lighting has been entered into by the Usk U.D.C.

## Reviews of Books

*A Report on the Gas Industry in Great Britain.* (*P.E.P. London, S.W.1. Pp.* 213, 10*s.* 6*d. net.*)

A comprehensive and instructive report on the gas industry, occupying over 200 pages, has been issued by P.E.P. (Political and Economic Planning). The initial Summary and Conclusions occupies about thirty pages, after which there are sections dealing in more detail with the uses of gas, the organisation of the industry, and proposals for development.

The industry itself is no mean one. During 1937 it produced some 1,500,000,000 therms of gas, employed about 125,000 workers, and served 11,000,000 consumers. Of these, nearly 7,000,000 pay through slot meters. Whilst, during the period 1920 to 1927 there was a steady increase in consumption, it is remarkable this was due almost entirely to the growth in the number of slot-meter consumers—the consumption of ordinary consumers remained almost stationary. The "load factor" is not, perhaps, such a serious item as in the electrical industry; yet it is interesting to observe that the average mains carry not more than 20 per cent. of their capacity. Consumption is decidedly irregular, as charts reveal. Between 10 a.m. and 1 p.m. on Sundays gas is being used faster than at any other time during the whole week—a fact, no doubt, helps to explain dwindling congregations at morning services! Attention is drawn to the very uneconomic way in which many households solve the fuel problem—four or more fuels being often used in small amounts in wasteful and dirty appliances.

Many odd items of information emerge from the report. The British gas industry, the largest in Europe, was, in 1937, shared between 706 statutory gas undertakings, though the twenty-four largest undertakings between them make 57 per cent. of the total output. The industry is in need of rationalisation in some respects. The large number of small units, acting separately, should, it is suggested, be co-ordinated. There should be one National Gas Authority, and "Gas Commissioners" with wide powers. The industry should be at liberty to adopt two-part tariffs similar to those usual in the electrical industry.

# Uni-Directional Street Lighting at Twickenham

A new system of lighting, stated to be the first of its kind, has been recently installed on the Great Chertsey Road, Twickenham. The system, developed in the G.E.C. Research Laboratories at Wembley, has for its aim the reduction in running costs (estimated at 60 per cent. or more) without sacrifice of efficiency; 125 watt lamps will thus effect what would previously have required 400 watt lamps, and with current at 1d. a unit the saving per post per year in running cost and lamp replacements is put at about £5.

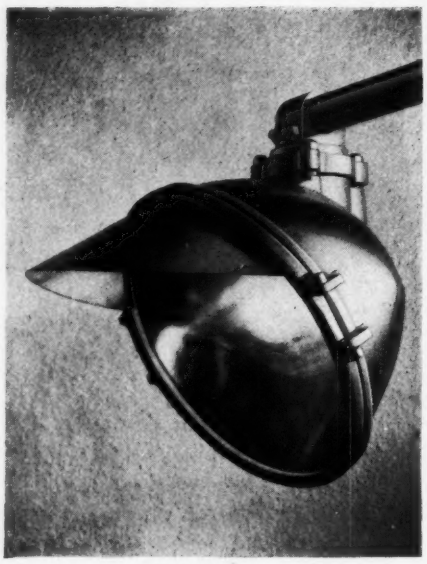

Fig. 1. The G.E.C. "Uniway" lantern for double carriageway roads, the medium through which the new system of Uni-Directional Lighting is applied.

Fig. 2. View of post, showing "Uniway" lanterns mounted in position.

The lighting of double carriageway roads is ordinarily expensive when lanterns of conventional type, designed to direct light up and down the road, are used. This is necessary on single carriageway roads, because traffic moves in both directions. The system installed at Twickenham, however, is based on the assumption that light need only be provided in one direction—opposing the traffic—on each carriageway of a dual road. The contrast of obstacles with the roadway is thus accentuated, and driving comfort is improved.

The G.E.C. "Uniway" lantern, the first lantern on the market made specifically for double carriageway roads, is designed for use with 80 and 125 watt Osira mercury vapour lamps.

The whole of the light is reflected towards the oncoming traffic, and a very even "flash" is obtained as a result of a special diffusing glass. The "flash" covers an area of more than 100 sq. in., whereas most ordinary 400 watt lanterns have a "flashed" area of only 60 or 80 sq. in., and the surface brightness of the lantern per square inch is correspondingly reduced. The outside surface of the glass is smooth to facilitate cleaning.

The lantern is in two parts—a detachable top into which the bracket arm slides horizontally, giving side entry mounting and the main lantern body. Both parts are made of light alloy castings, and the complete unit weighs only 15 lb.

The "Uniway" lantern is totally enclosed, non-ventilated, and completely weatherproof. The front is hinged at one side and secured by simple positive action snap catches. Access to the lamp and reflector is afforded by the hinged front.

The body can be rotated on the bracket arm so that the light can be accurately directed towards the part of the road to be illuminated. For this purpose an orthoptic sighting device is provided to enable the lantern to be correctly aligned. The lamp is automatically centred and is firmly held in the correct focal position.

Fig. 3. A daylight view of the Great Chertsey Road, Twickenham, where the new Uni-Directional Lighting has been installed.

Fig. 4. A section of the same road showing the effect by night.

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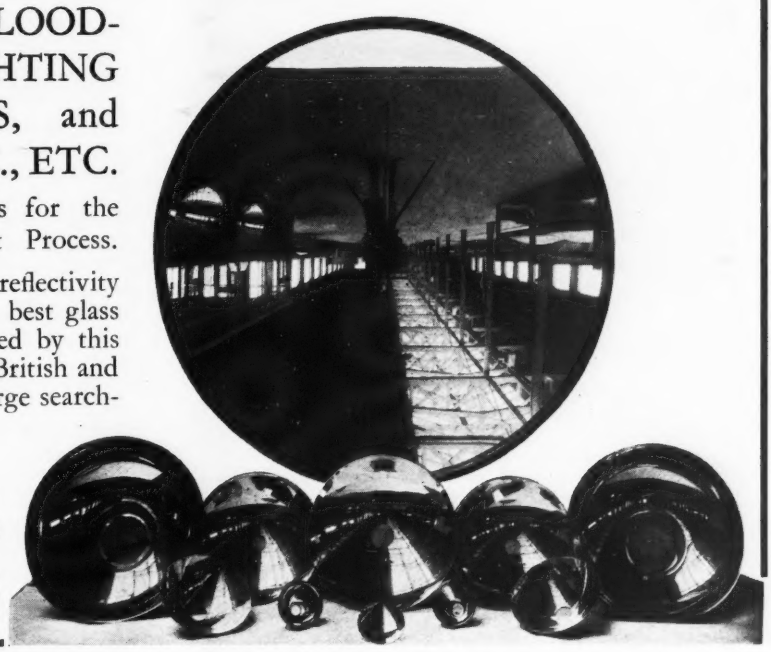

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# LIGHT IN DAILY LIFE

BY J. STEWART DOW

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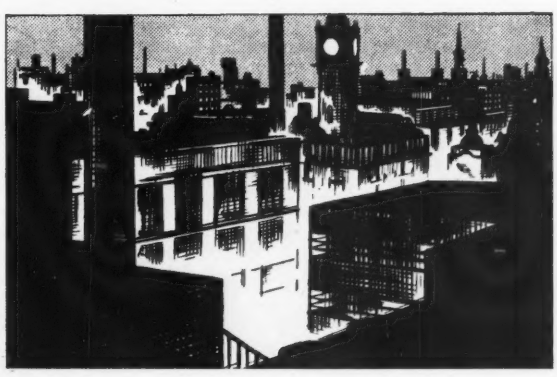


# NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

### Sweden.

The picture above shows a view, presented in "Ljuskultur," of the printing works of a Stockholm newspaper lighted by special fittings, each measuring approximately 8 ft. by 6 ft. The canopy is of metal. The lamps (75 watt or 100 watt) are located in bowls of opal diffusing glass.

### Germany.

A recent issue of "Das Licht" was devoted to a large extent to decorative lighting and problems connected therewith. Dr. Weigel and Dr. Arndt comment on the general developments. The need for co-operation, on the basis of mutual respect for their individual tasks, between architect and lighting expert is emphasised. The first condition to be met is that the lighting expert should furnish the fundamental technical solutions. The architect has the task of fitting these to an appropriate style for the particular job. Dr. Arndt, in discussing the relation of the lighting engineer to all forms of lighting application, points out that the lighting technique, being a comparatively new science, must necessarily fit in with all those other branches of science with which lighting is associated. The lighting expert should act as the liaison officer between the lighting science and these other branches and should devise solutions of technical problems in the common interests. In this connection he criticises certain trends advocated in trade publications in Germany; for instance, the introduction of daylight effects in the field of home lighting. He voices the opinion that the average man likes a "warm" light during the evening, and that the endeavour to create daylight effects is not in line with this inherent taste.

In the same publication there is also a report by Mr. Kircher regarding the development of illuminating glassware for home application. The German I.E.S. has taken the initiative, in co-operation with certain authorities, to induce the glass industry to develop new forms of a more modern character which would overcome present difficulties in a psychological way. It has been observed that opalised glass is often refused on account of the impression of "coldness" it creates, while clear glass is, in many cases, unsuitable owing to glare. The new lines suggested to the German glass industry aim particularly at a soft tinting of the glass and a less intensive diffusing effect. Regarding the development of lamp shades a new feature is the recently launched shade made of so-called "wooden skin." "Licht und Lampe" reports that such shades, which can be made in all sizes for standards, wall brackets, etc., consist of a very thin wooden fournure attached to a very fine, completely transparent fabric. The material is entirely elastic and can be moulded like other materials for shade production. It is available in sheets of approximately 60 sq. ft., in quite a considerable range of varieties of wood. In addition to the warm lighting effect produced by such shades they have the practical advantage of being easy to clean.

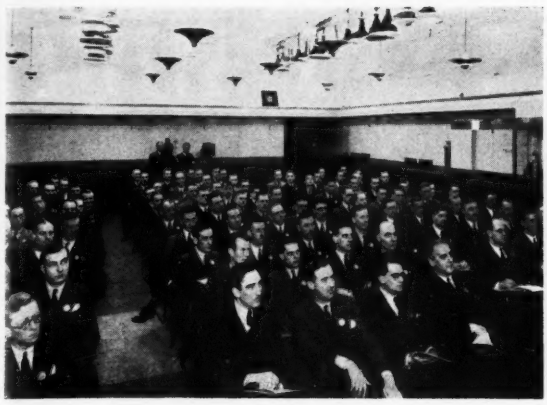
## Polarised Glass for Train Windows

A very enterprising step, mentioned in the "Railway Gazette," is the adoption of circular "polaroid" windows in the observation car of the "Copper King," the streamlined Los Angeles train of the Union Pacific Railroad. There are twenty-nine circular windows, each 27 in. in diameter, and consisting of a fixed and rotatable polaroid disc with a protecting outer window of safety glass. By turning the rotatable disc the glare of sunlight can be dimmed until comfort is secured. In addition, as reflected light is always to a great extent polarised, the stationary disc can be set (irrespective of the position of the movable disc) to tone down inconveniently bright reflections from sheets of water, etc.

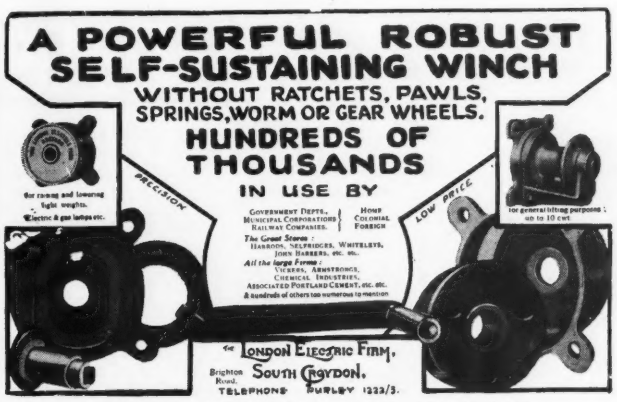
## Obituary

### William Thomas Dean

We regret to record the death of Mr. W. T. Dean, Managing Director of Holophane, Ltd., which occurred suddenly at Washington. Mr. Dean was on a business visit to the U.S.A., for which he sailed on April 8, apparently in good health. He was associated with Holophane, Ltd., for over thirty years, and as sales manager and managing director for the past three years. A founder member of the Electric Light Fittings Association, he was well known in electrical circles. He was a member of the Illuminating Engineering Society for many years, and took a keen and sympathetic interest in its doings.



A view of the audience at the 40th E.L.M.A. Illumination Design Course, attended by over 150 representatives of the electrical industry.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# The Illuminating Engineering Society (U.S.A.)

## Notes on Transactions (March, 1939)

NEWS: *On May 19 the I.E.S. is arranging a meeting at the World's Fair* at New York, on a large scale, for all chapters and sections and their guests. The programme includes inspection of the most interesting parts of the Fair and a dinner in the Casino of Nations. Over 1,000 people are expected to attend. *Reflection values from surfaces* painted with twenty-one indoor colour variations have been tested by being subjected alternately to the light from a tungsten lamp and a mercury vapour lamp. The resulting variations amount to 2 per cent. to 5 per cent. The Chicago Lighting Institute held a three days *Industrial Lighting Conference* which was attended by sixty-nine people, forty-four of whom were representatives from public authorities. Messrs. M. Luckiesh and F. Moss recently announced the development of a *"blink" test* as a method for measuring and comparing degrees of human fatigue induced by various visual tasks. *Two new photo-flash lamps*, one foil filled and the other wire filled, have been introduced. The foil filled has a flashing intensity of round about 20,000 lumen-seconds, the wire filled approximately 40,000. The wire-filled type should be used preferably on batteries.

SUBJECTS OF PAPERS: *"Indirect Luminaires—Efficient and Inefficient,"* by Ward Harrison. The results of comparative investigations of present commercially available types of indirect luminaires, their efficiency and the degree of eye comfort produced, are given. Efficiencies varied from 51 per cent. to 86 per cent. In certain cases variations in the same fitting equipped with a clear or pearl bulb lamp respectively amount to 19 per cent., apart from the fact that the distribution curve is much altered. A special treatment of ceilings which tends to avoid glare from brightness of ceilings lit indirectly to great intensity is described. The paper also discusses the merits and possible objections of coffer-lighting arrangements which are now favoured for certain applications.

*"The Influence of General Lighting on Machine Shop Tasks,"* by H. M. Sharp and C. L. Crouch. The "revealing power" of lighting systems for general illumination is investigated for various systems of lighting. The method of comparison used was to put identical test objects (for instance, scribing on metal surfaces) in identical positions under varied lighting arrangements and to measure the relative visibility by the Luckiesh-Moss Visibility Meter. Investigations of the revealing quality of illumination, objectionable reflection from objects and objectionable direct glare from lighting units in the eyes of the worker, led to the following results: All systems in common use fall short of the ideal of completely revealing detail and give rise to highlights of objectionable brightness measured both from comfort and disability viewpoints. Direct emission of flux towards the eye of the worker is generally sufficient to cause a reduction in seeing visibility.

*"Practical Aspects of Luminous Storefronts,"* by H. M. Alexander. The influence of luminous areas for store fronts is discussed from the architectural aspect. Technical points are touched upon and materials for successful design are discussed, including prices, etc.

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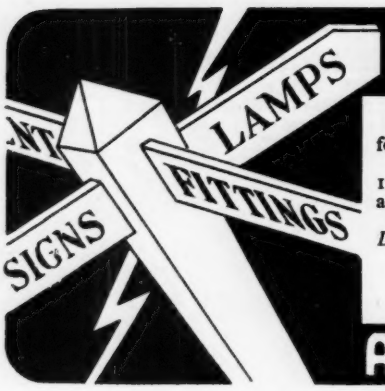


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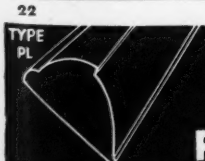
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ELECTRIC LAMPS of all types. "SIERAY" ELECTRIC DISCHARGE LAMPS. ELECTRIC LIGHT FITTINGS. FLOODLIGHTING APPARATUS. SHOP-WINDOW LIGHTING EQUIPMENT. STORE LIGHTING. INDUSTRIAL LIGHTING, CINEMA LIGHTING, ELECTRIC SIGNS, ETC.
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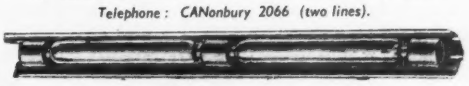
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32
**STRAND ELECTRIC**
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SPECIALISTS IN COLOUR LIGHTING and STAGE EQUIPMENT
LIGHTING FOR EVERY OCCASION
THEATRES: EXHIBITIONS
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33
For every type of GAS LIGHTING
**SUGG** WESTMINSTER
When you want the best!
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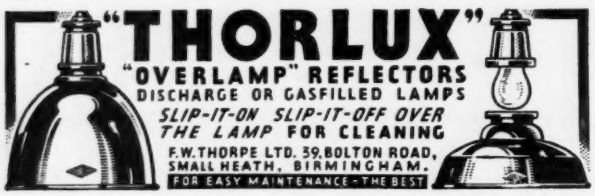
34

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"OVERLAMP" REFLECTORS
DISCHARGE OR GASFILLED LAMPS
SLIP-IT-ON SLIP-IT-OFF OVER THE LAMP FOR CLEANING
F.W. THORPE LTD. 39, BOLTON ROAD, SMALL HEATH, BIRMINGHAM.
FOR EASY MAINTENANCE - THE BEST

35
ULTRALUX AND LOUVERLUX FITTINGS *See them at*
**THE LIGHTING CENTRE** LTD
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36
**WARDLE ENGINEERING Co., Ltd.**
OLD TRAFFORD, MANCHESTER, 16.
STREET LIGHTING EQUIPMENT. FLOODLIGHT PROJECTORS
WORKSLITE REFLECTORS. WARDELYTE GLASSWARE
PRISMALUX DIRECTIONAL UNITS.

**SITUATION DESIRED**

**Specialist in electric lighting, lamps and fittings, having qualified for electrical and consulting engineering in Austria, desires position with leading firm concerned with illuminating engineering. For many years technical manager of important branch of one of the largest European electrical companies. Experienced organiser, fully conversant with English, French, and German. Box No. 443.**

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*N.B.—The numbers are those attached to individual entries in the Directory (See pp. 112—114)*

## Effect of Discharge Lamps on Posters

An interesting note in "The Poster," the official organ of the British Poster Advertising Association, contains a report of a committee set up by the Association to investigate colour distortion caused by new methods of street lighting. The chief conclusions in the report are (1) Distortion is negligible in the case of mercury vapour lamps, in which the glass in sprayed internally with fluorescent powder; (2) public authorities should be urged to instal such lamps wherever possible; (3) where uncorrected mercury lamps are in use floodlighting with tungsten filament lamps helps to counteract distortion; (4) additional floodlighting with tungsten filament lamps is the only possible method of correction where sodium lamps are concerned. The Committee urge manufacturers to accelerate further research on this problem, and also presents a list of the colours found to be least liable to distortion, and, therefore, most suitable for use in poster design.

## Rhodium-Plated Metal Reflectors

An interesting development recently undertaken by Messrs. C. A. Parsons and Co., Ltd., of Newcastle-upon-Tyne, is the manufacture of rhodium-plated metal reflectors by a process, for which they have acquired the exclusive rights for the British Empire. By this process it is possible to produce rhodium-plated metal reflectors of high optical accuracy and high reflectivity, such as is required for use in large searchlight projectors. The process is also applicable to the production of mirrors for floodlights, spotlights, cinema projectors, etc.

## Extension to Strowger Works

On Monday, April 3, the foundation stone of a new four-storey extension to the Strowger Works, Liverpool, of Automatic Telephone and Electric Company, Ltd., was laid by the Secretary of State for Air, the Rt. Hon. Sir Kingsley Wood, M.P., in the presence of the Lord Mayor of Liverpool (Alderman Sir Sydney Jones), the Rt. Hon. the Earl of Derby, K.G., and a number of distinguished guests. The building thus inaugurated is almost completed.

Before proceeding to the new extension Sir Kingsley visited the assembly departments, where he saw employees working on contracts for automatic telephone equipment, street fire alarm apparatus, rythmatic control for street lighting and other public services, and other light-current signalling products. After the ceremony he was presented with an ingenious souvenir of his visit—a cigar-cutter representing the nose of an aeroplane fashioned in the shape of a silver automatic telephone dial.

## Catalogues, etc., Received

GENERAL ELECTRIC COMPANY, LTD.—Leaflets featuring Lighting Fittings for Hospitals, Sanatoria, Nursing Homes, etc., and the "Home Series" of Lighting Fittings. Also the "Osram Bulletin" (March, 1939).

HOLOPHANE, LTD.—Leaflet featuring the new "Correctalite" Reflectors, fitted with a special blue prismatic glass.

TROUGHTON AND YOUNG, LTD.—Supplement to Decorative Catalogue, illustrating some attractive new styles of pendant fittings, mainly of the indirect and semi-indirect type.

UNITED STATES JUNIOR CHAMBER OF COMMERCE.—"Safety with Light," an illustrated Programme Manual, emphasising the value of good street lighting.